

Duo-i6525

USER MANUAL

Version 1.0



2607 Colorado Blvd.
Los Angeles, CA 90041
USA

Tel: 323-254-8131

Fax: 323-254-4928

www.adrftech.com

Glossary

The following is a list of abbreviations and terms used throughout this document.

Abbreviation/Term	Definition
AGC	Automatic Gain Control
ALC	Automatic Level Control
AROMS	ADRF' Repeater Operation and Management System
BTS	Base Transceiver Station
CDMA	Code Division Multiple Access
CFE	Compact Front End
CW	Continuous Wave (un-modulated signal)
DAS	Distributed Antenna System
DL	Downlink
Downlink	The path covered from the Base Transceiver Station (BTS) to the subscribers service area via the repeater
HPA	High Power Amplifier
HW	Hardware
iDEN	Integrated Digital Enhanced Network
IF	Intermediate Frequency
LNA	Low Noise Amplifier
MS	Mobile Station
PLL	Phased Locked Loop
PS	Power Supply
RF	Radio Frequency
SQE	Signal Quality Estimate
SW	Software
UL	Uplink
Uplink	The path covered from the subscribers service area to the Base Transceiver Station(BTS) via the repeater
VSWR	Voltage Standing Wave Ratio

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Please send comments to:

E-Mail: info@adrfttech.com

Phone: (323) 254-8131

Fax: (323) 254-4928

Address: Advanced RF Technologies, Inc.
Attention: Technical Publications Department
2607 Colorado Blvd., 1st Floor
Los Angeles, CA 90041
USA
www.adrfttech.com

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1. Duo-i6525

1.1. Introduction

Duo-i6525 is a dual band SMR (800 and 900 MHz) RF repeater which enhances in-building wireless coverage in the most effective and cost efficient way. For its intelligent design and versatility, the Duo-i6525 is the ideal choice for wireless coverage problems indoors. Duo-i6525 can be used as a stand-alone repeater with passive antennas connected to it or it can also be used as a feeder repeater to a DAS (Distributed Antenna System).

1.1.1. Highlights

- Dual Band Repeater (800 & 900 MHz)
- 25 dBm Composite Output Power
- 65 dB gain
- 25 dB AGC Range @ 0.5 dB Step
- Digital Filtering
- Excellent out of band rejection characteristics with Sharp Roll-Offs @ 65 dBc
- Re-Banding Capability via Digital Filtering
- Band Adjustable Option @ 200 KHz step
- Web GUI Software via DHCP
- Oscillation Detection Scheme

1.1.2. Parts List

Label	Qty	Description
A	1	iDEN Repeater
B	1	AC Power Cable
C	1	Ground Cable
D	1	Ethernet Cable (Twisted)
E	4	guard screws
F	1	CD

Table 1 – Parts List

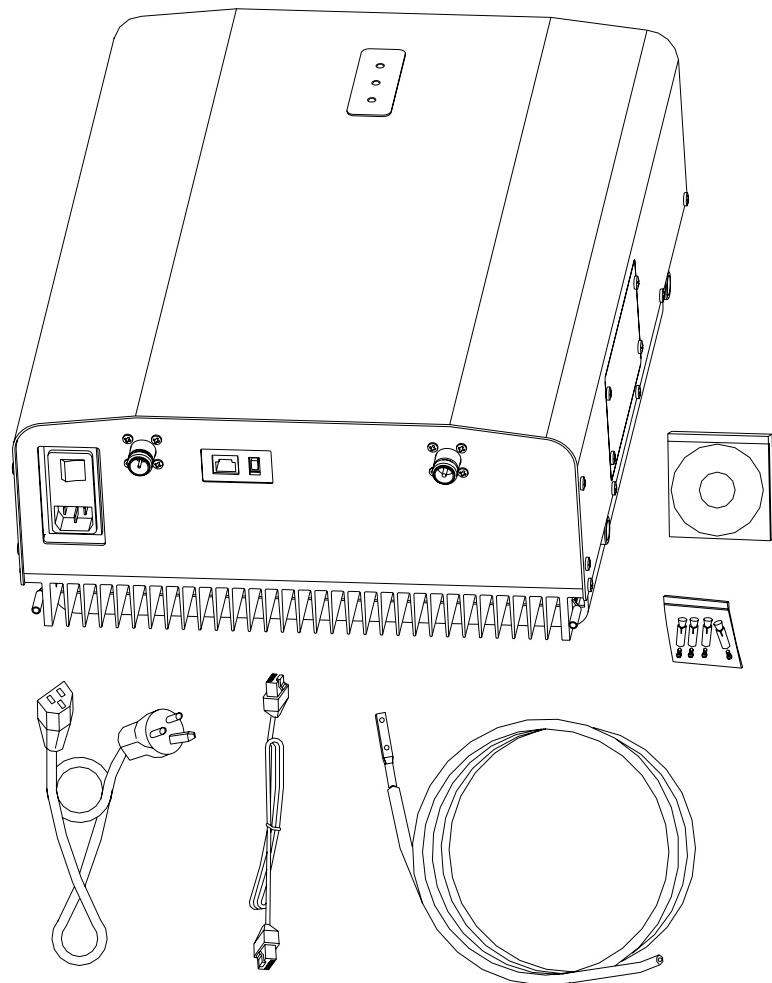
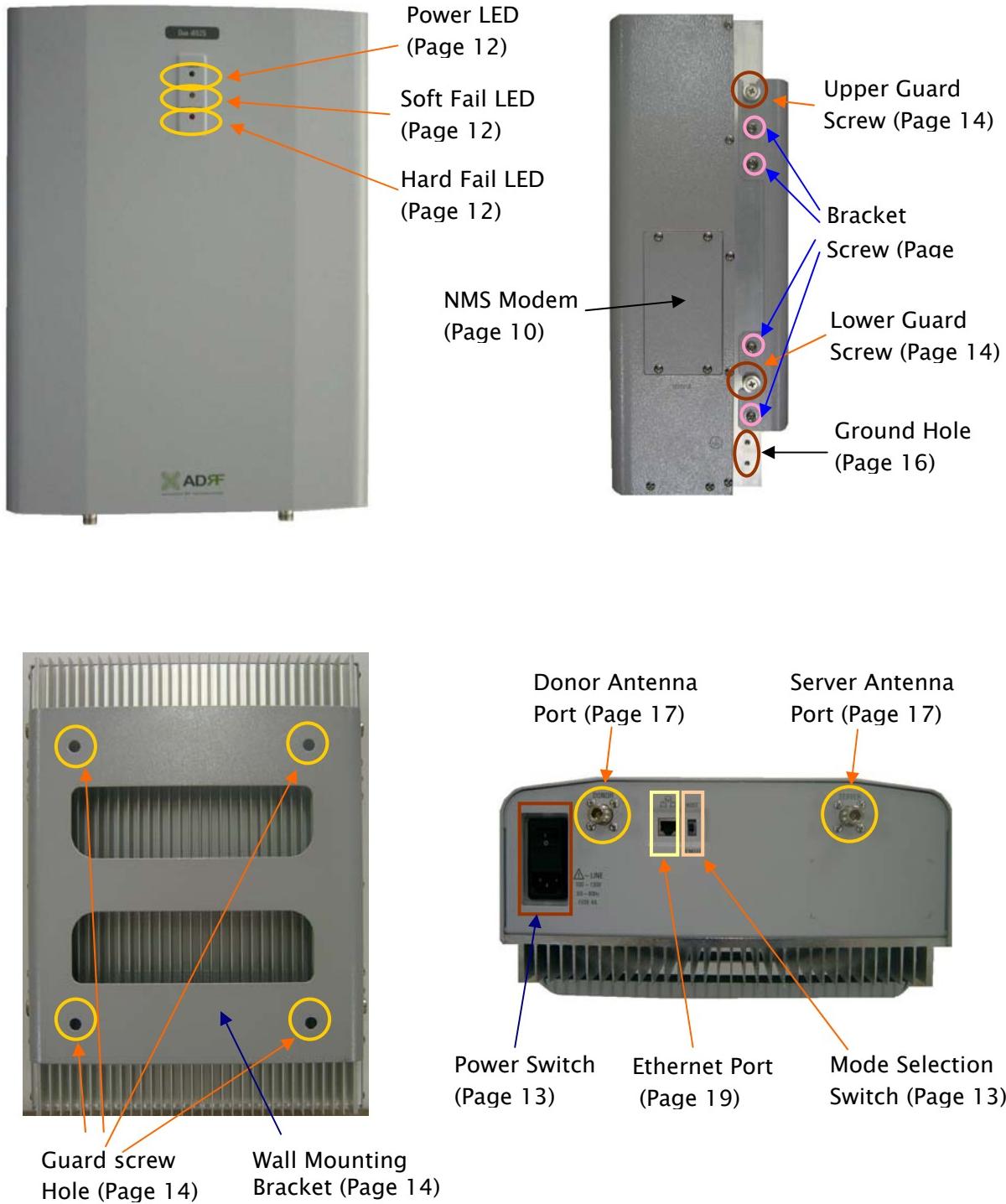


Figure 1 – Duo-i6525 Repeater Parts List

** CD includes: (1) Duo-i6525 User Manual & (2) Duo-i6525 Quick Start Guide

1.1.3. Repeater Quick View



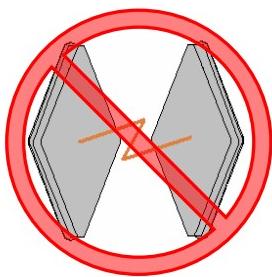
1.2. Warnings and Hazards

**WARNING! ELECTRIC SHOCK**

Opening the Duo-i6525 could result in electric shock and may cause severe injury.

**WARNING! EXPOSURE TO RF**

Working with the repeater while in operation, may expose the technician to RF electromagnetic fields that exceed FCC rules for human exposure. Visit the FCC website at www.fcc.gov/oet/rfsafety to learn more about the effects of exposure to RF electromagnetic fields.

**WARNING! DAMAGE TO REPEATER**

Operating the Duo-i6525 with antennas in very close proximity facing each other could lead to severe damage to the repeater.

RF EXPOSURE & ANTENNA PLACEMENT Guidelines

Actual separation distance is determined upon gain of antenna used.
Please maintain a minimum safe distance of at least 20 cm while operating near the donor and the server antennas. Also, the donor antenna needs to be mounted outdoors on a permanent structure.

WARRANTY

Opening or tampering the Duo-i6525 will void all warranties.

2. Duo-i6525 Overview

2.1. Block Diagram

iDEN Dual Repeater(Duo-i6525) Block Diagrams

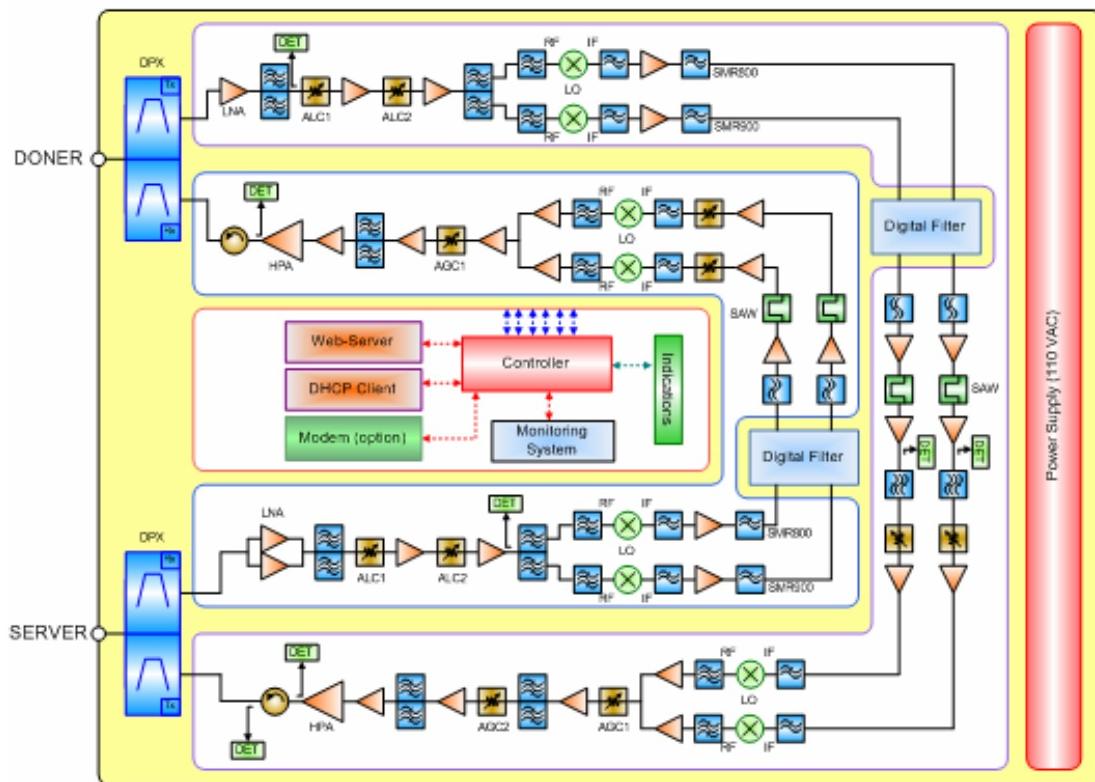


Figure 2 – Duo-i6525 Repeater Block Diagram

2.2. Operation Modes

2.2.1. Local Web GUI

Simply connect one end of the ethernet cable on the repeater monitor port and the other end on the PC's LAN port. After doing so, launch the Microsoft Internet Browser (Internet Explorer) and the Local Web GUI will be launched through typing the IP address (<http://192.168.63.1/home.asp>)

2.2.2. Remote NMS (Modem Option)

A CDMA wireless modem can be integrated within a Duo-i6525 repeater. With this wireless modem, the user can remotely log into the repeater for monitoring purposes.

2.3. Components

2.3.1. 2.3.1 Power Supply

It provides DC power to each module within the repeater.

2.3.2. Controller

It is responsible for monitoring the status of each module and controls its parameters. If a CDMA wireless modem is integrated within the repeater, it also handles the remote "Command & Control" feature as well.

2.3.3. Down Converter Module

The downlink RF signal entered through the cavity filter is converted to IF frequency, which is later converted back to RF frequency again through digital filtering. The downlink HPA (high power amplifier) is integrated with the Down Converter Module.

2.3.4. Up Converter Module

The uplink RF signal entered through the cavity filter is converted to IF frequency, which is later converted back to RF frequency again through digital filtering. The uplink HPA (high power amplifier) is integrated with the Up Converter Module.

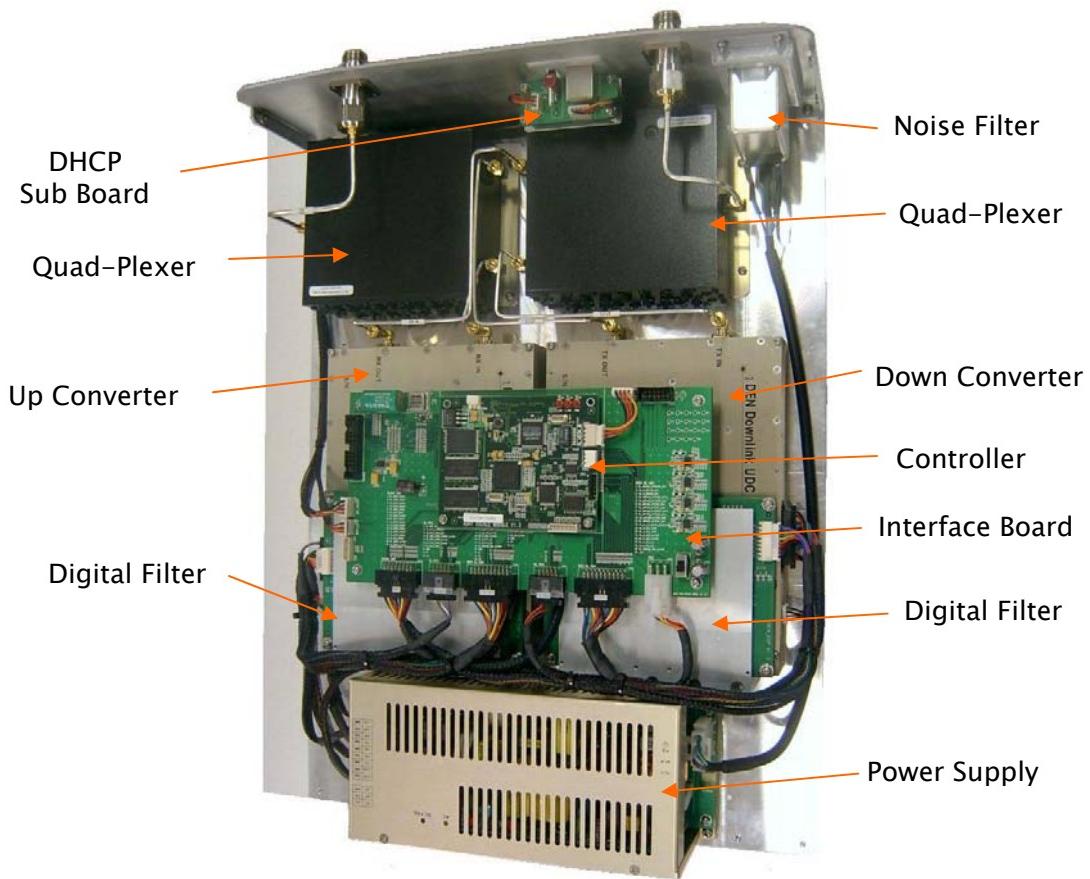


Figure 3 – Duo-i6525 Repeater Internal Components Diagram

2.3.5. Quad-Plexer

It consists of four BPFs (band-pass filters) each of the four RF signal paths:
 SMR 800 (Tx & Rx) and SMR 900 (Tx & Rx)

2.3.6. Digital Filter

It is composed of A/D (analog to digital) and D/A (digital to analog) converters.
 It also has a FPGA (field programmable gate array) which has the capability
 for superior out-of- band rejection and re-banding.

2.4. Switches & Indicators

2.4.1. LEDs

Duo-i6525 has three LEDs on the top panel of the repeater as show below in Figure 4.



Figure 4 – Duo-i6525 Repeater LED View

POWER

If the LED is lit GREEN, it indicates that there is AC power to the repeater.

SOFT FAIL

If the LED is lit YELLOW, it indicates that there is a soft fail alarm in the system. The detailed alarm information can be viewed via the local web GUI. In the event of a soft fail alarm, the repeater will still function, but the alarm needs to be addressed promptly.

HARD FAIL

If the LED is lit RED, it indicates that there is a hard fail alarm in the system. The detailed alarm information can be viewed via the local web GUI. In the event of a hard fail alarm, the repeater will not function and immediate attention is required.

2.4.2. Power Switch

The AC Power on/off switch is located on the bottom of repeater. The switch should be powered on after the repeater has been installed properly.



Figure 5 – Duo-i6525 Repeater Power Switch View

2.4.3. Mode Selection Switch

The Ethernet port and the mode selection switch for DHCP are located on bottom of the repeater as shown below in Figure 5. The mode selection switch has two modes: Host Mode & Remote Mode.

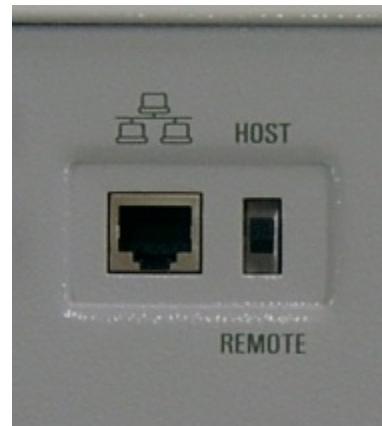


Figure 6 – DHCP & Mode Selection Switch View

Host Mode

This mode should be selected only if a Duo-i6525 is used alone without being connected to a collocated Sprint Nextel CDMA repeater functioning as a host.

Remote Mode

This mode should be selected if a Sprint Nextel CDMA repeater is being installed along with a Duo-i6525 and the ethernet port is being used for communicating with the CDMA repeater. In this case, a Duo-i6525 works as a remote sending its information to the collocated Host CDMA repeater.

2.5. Installation

2.5.1. Tools

No special tools or equipments are needed in installing the Duo-i6525.

2.5.2. Procedure

Four mounting holes are provided on the wall-mounting bracket to attach it to the wall. The wall bracket must be securely attached to sufficiently carry the weight of the Duo-i6525, which is bolted to the wall bracket through four aligned mounting holes.

The following steps should be followed while mounting the repeater:

Installation Procedure

- ① Take the Duo-i6525 out of the box
- ② Detach the mounting bracket from the Duo-i6525 by unscrewing the 8 screws on the bracket. (4 on each side)
- ③ Using the four guard screws, mount the bracket on the wall
- ④ Make sure the bracket is securely mounted
- ⑤ Slightly tilt the repeater and mount the repeater onto the wall as shown in the picture. Hook the upper 2 guard screws first and then slide/push in the lower 2 guard screws into the place.
- ⑥ Make sure the repeater is securely placed onto the wall bracket
- ⑦ Fasten the 8 bracket screws back properly
- ⑧ Inspect everything is secure

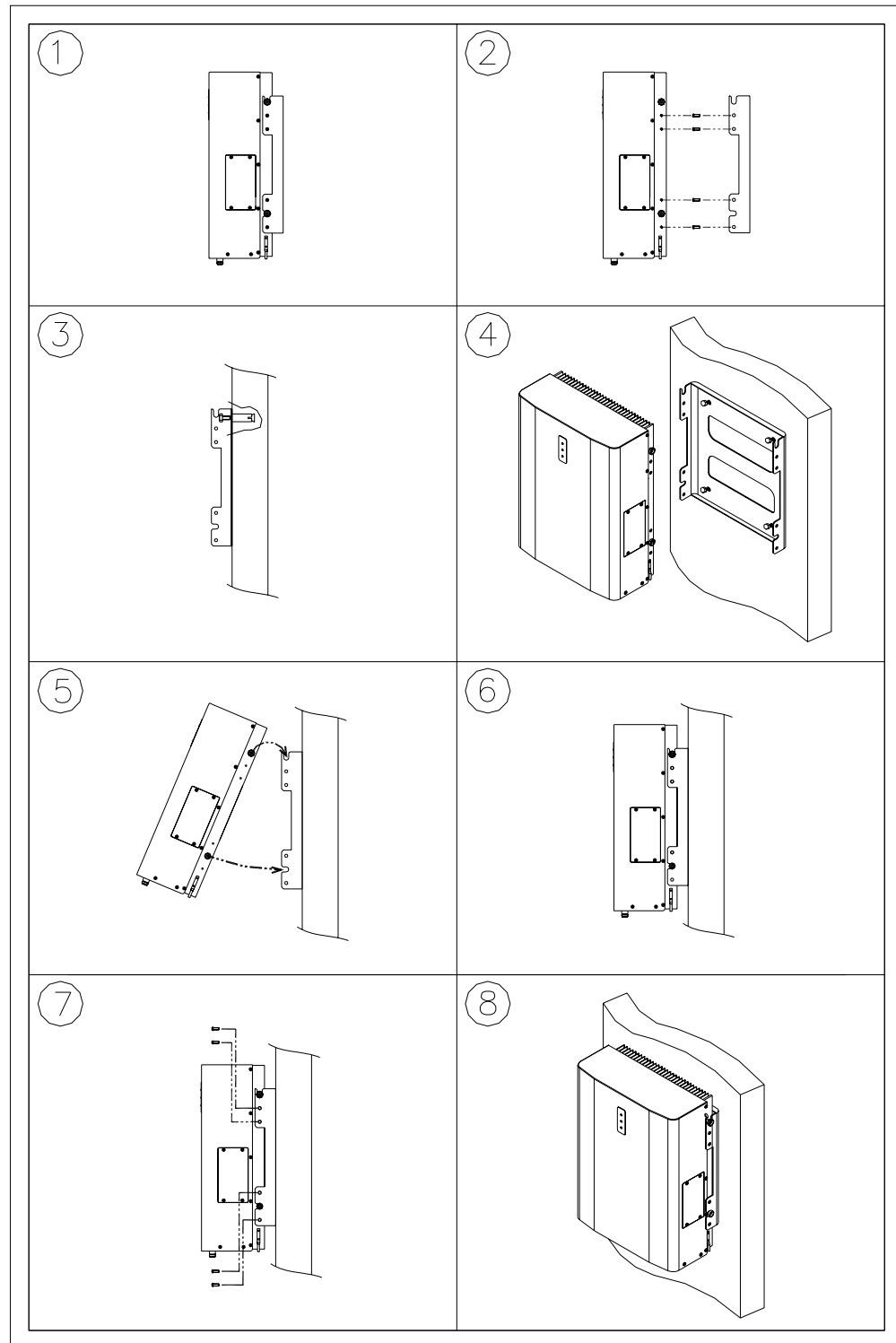


Figure 7 – Repeater Mounting Instructions

2.5.3. Grounding

The Duo-i6525 has locks on the side of the enclosure preventing from the door opening. In addition, a ground cable is also included in the box and should be connected to repeater.



Figure 8 – Ground Cable Connection

2.5.4. Antenna Separation/Isolation

Separation between antennas is necessary to prevent oscillation. Oscillation occurs when the signal entering the system continually reenters, due to the lack of separation between the donor and server antennas. In other words, the signal is being fed back into the system. This creates a constant amplification of the same signal. As a result, the noise level rises above the signal level.

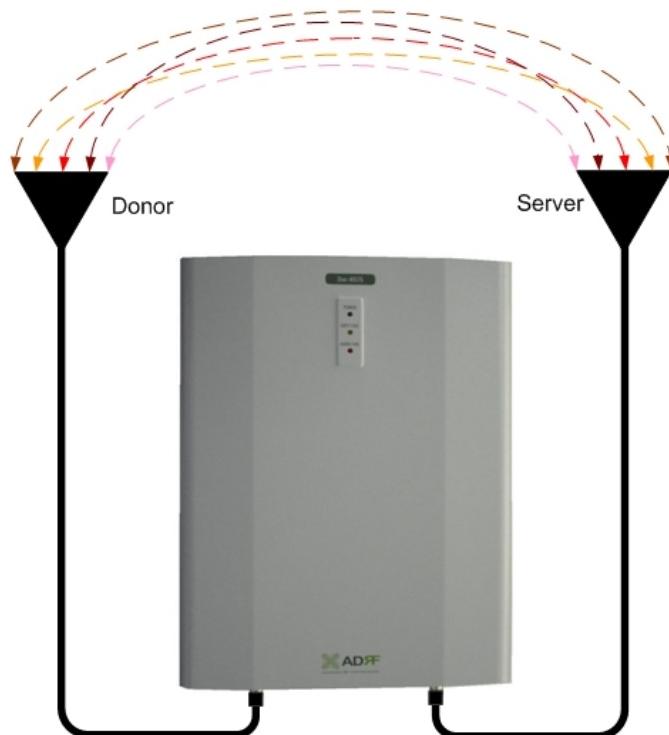


Figure 9 - RF Repeater Oscillation

To prevent feedback, the donor and server antennas must be separated by an appropriate distance to provide sufficient isolation. Isolation is attained by separating antennas a sufficient distance so that the output of one antenna does not reach the input of the other. This distance is dependent on the gain of the repeater.

A sufficient isolation value is $13 \sim 15$ dB greater than the maximum gain of the repeater. For example, if the gain of the repeater is 50 dB, then an isolation of $63 \sim 65$ dB or greater is required. In the same manner, because the Duo-i6525 has a maximum gain of 65 dB, it requires an isolation of at least $78 \sim 80$ dB.

2.5.5 Line of Sight

The donor antenna which points towards the base station typically has a narrow beam antenna pattern. As a result, a slight deviation away from the direction of the BTS can lead to less than optimum results. In addition, obstacles between the repeater and the BTS may impair the repeater from obtaining any BTS signal. As a result, the repeater cannot transmit signal to the coverage area. Therefore, a direct line of sight to the BTS for the donor antenna is vital to the function of a repeater. For the same reason, placing the server antenna in direct line of sight of the coverage area is also necessary.

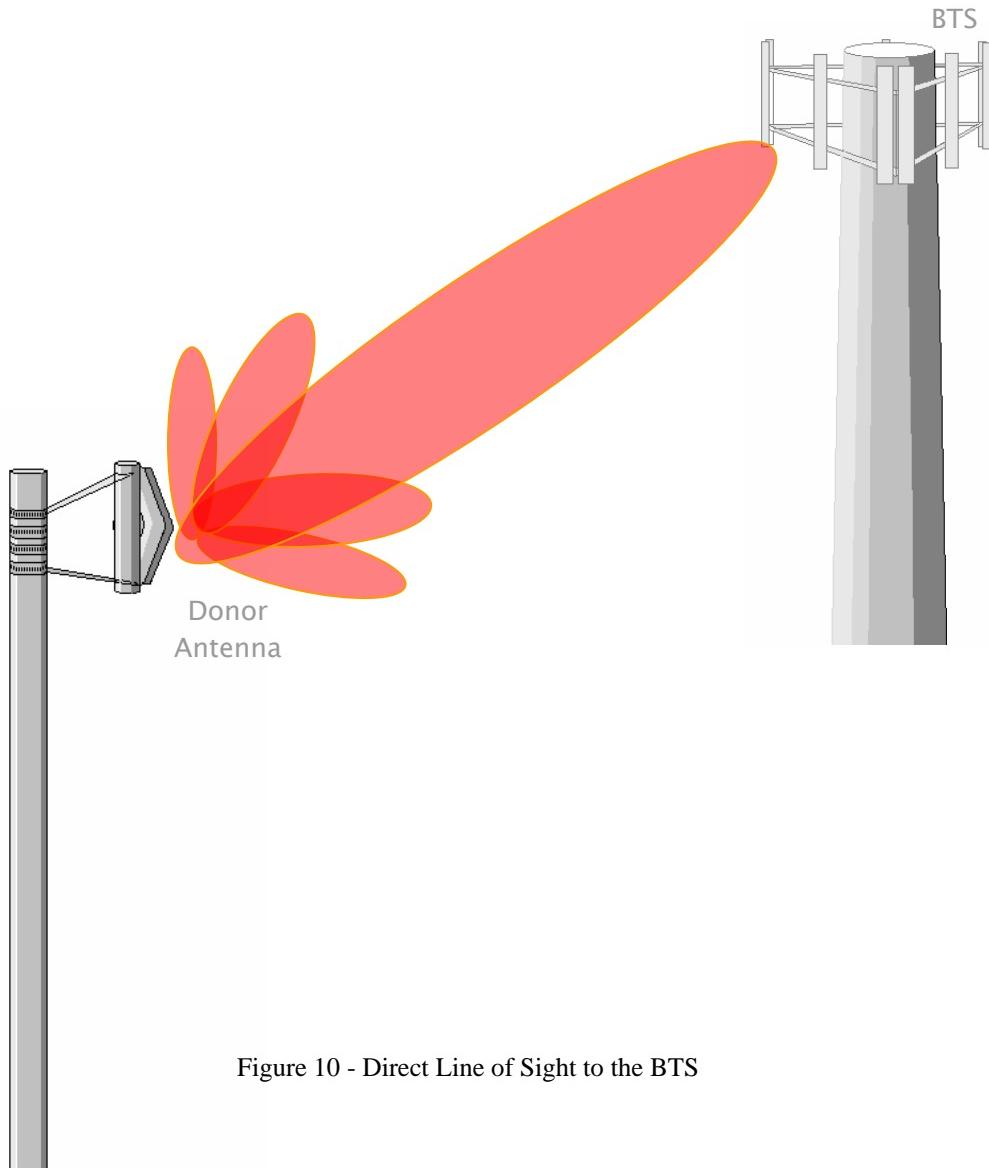
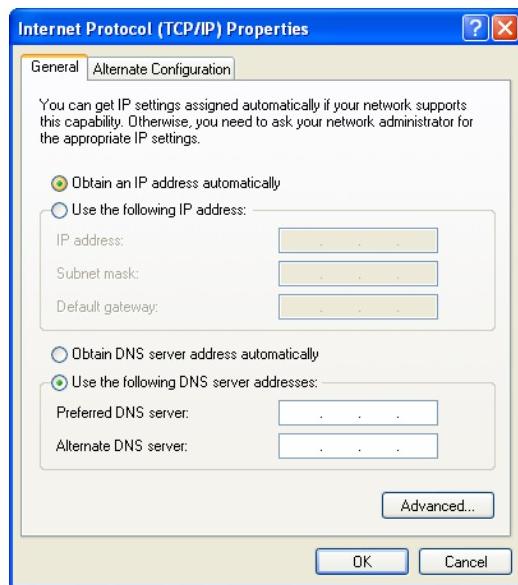
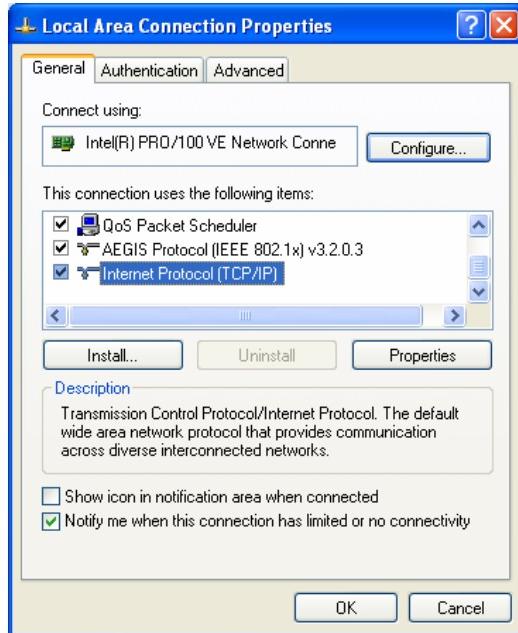


Figure 10 - Direct Line of Sight to the BTS

3. Duo-i6525 AROMS Setup

- Connect the LAN cable between laptop's Ethernet port and repeater's Ethernet port.

Note: Under Local Area Connection in Network Settings, make sure to select **Obtain an IP address automatically** under Internet Protocol (TCP/IP) properties.



- ii) Launch MS Internet Explorer (Version 6.0 or higher)

Note: ADRF's Web GUI is not compatible with any other web browsers (e.g. Netscape, FireFox, Mozilla, etc.).

- iii) Please type the following IP address on the address bar of MS Internet Explorer:

<http://192.168.63.1/home.asp>

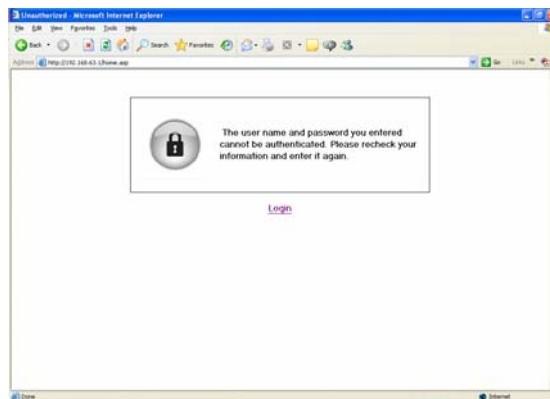
- iv) The following login screen will appear:



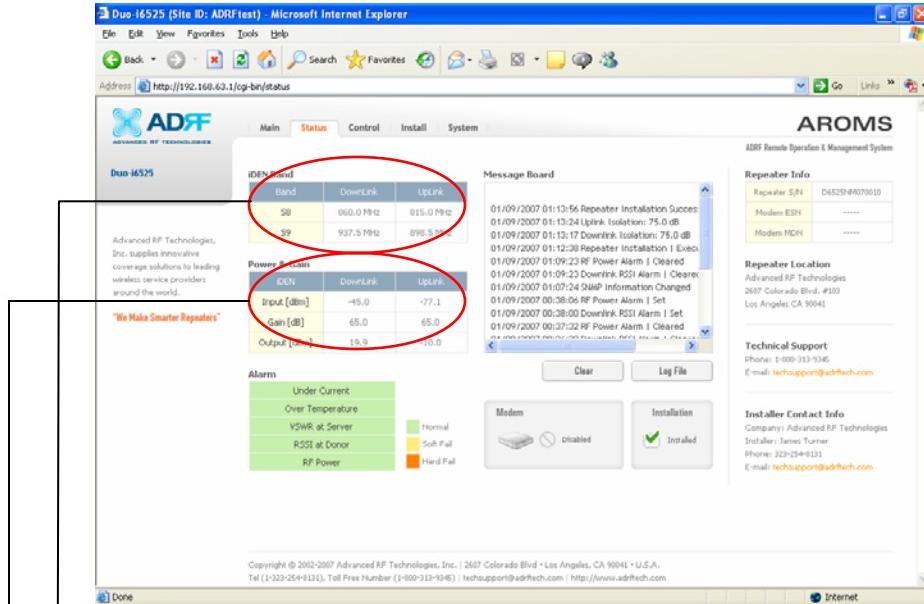
If you are not the Super-User, please type in your assigned username & password which you should have received from the Super-User.

The default username and password for the General User is **adr** & **adr**, respectively.

If the username & password is typed in incorrectly, the following screen will appear:



- v) If you click on Status tab, the following window will appear:



iDEN Band		
Band	DownLink	UpLink
S8	860.0 MHz	815.0 MHz
S9	937.5 MHz	898.5 MHz

Power & Gain		
iDEN	DownLink	UpLink
Input [dBm]	-45.0	-77.1
Gain [dB]	65.0	65.0
Output [dBm]	19.9	-10.0

In this window, the user can **view** the following:

To **change** any parameters, e.g., iDEN Band, Gain Settings, you have to go to Install or Control Menu.

- iDEN Band: Will display the center frequencies of the 800 and 900 MHz spectrums on the downlink and uplink respectively.

→ **iDEN Band**

Band	DownLink	UpLink
S8	860.0 MHz	815.0 MHz
S9	937.5 MHz	898.5 MHz

- Power & Gain: Will display the repeater input, gain and output power on the downlink and uplink.

→ **Power & Gain**

iDEN	DownLink	UpLink
Input [dBm]	-45.0	-77.1
Gain [dB]	65.0	65.0
Output [dBm]	19.9	-10.0

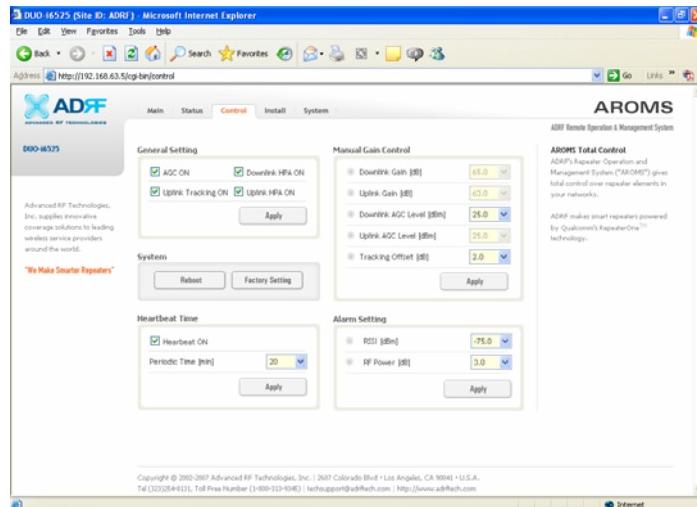
- Alarm: Will display five alarms with three different status conditions (Normal, Soft Fail or Hard Fail).
- Message Board: Will show up to recent 20 log messages (Alarms & Heartbeats).
- Modem: Will display the status of the mode (e.g. Disabled, Not Connected or Connected)
- Installation: Will display repeater's installation status (Not Installed or Installed).
- Repeater Info: Will display repeater's serial number, modem ESN and MDN.
- Repeater Location: Will display the address where the repeater is installed
- Technical Support: Will display ADRF's Technical Support contact information.
- Installer Contact Info: Will display the installer's name, phone and e-mail address.

Note: Once successfully logged in, the repeater model name and the site/cascade ID will be displayed on the top of all the windows (except for the Main Window).

Parameters	Range	Step Size
DL/UL Output Power	-10 ~ 28 dBm	0.1 dB
DL Input Power	5 ~ -95 dBm	0.1 dB
Gain	40 ~ 65 dB	0.5 dB

Table 2 – Default Parameter Ranges

- vi) If you click on **Control tab**, the following window will appear:



In this window, the user can adjust the following parameters:

General Setting

- Automatic Gain Control (Default mode is Off)

- Downlink HPA on/off (Default mode is On)
- Uplink HPA on/off (Default mode is On)
- Uplink Tracking mode on/off (Default mode is Off)

Manual Gain Control

- Downlink Gain Control (40 to 65 dB @ 0.5 dB step, default value: 25 dB)
- Uplink Gain Control (40 to 65 dB @ 0.5 dB step, default value: 25 dB)
- Downlink AGC Level (15 to 25 dBm @ 0.5 dB step)
- Uplink AGC Level (15 to 25 dBm @ 0.5 dB step)
- Uplink Tracking Offset (0 to 10 dB @ 0.5 dB step - Default mode is Off)

System

- If you click the Reboot button, the following message box will appear:



- If you click the Factory Setting button, the following message box will appear:



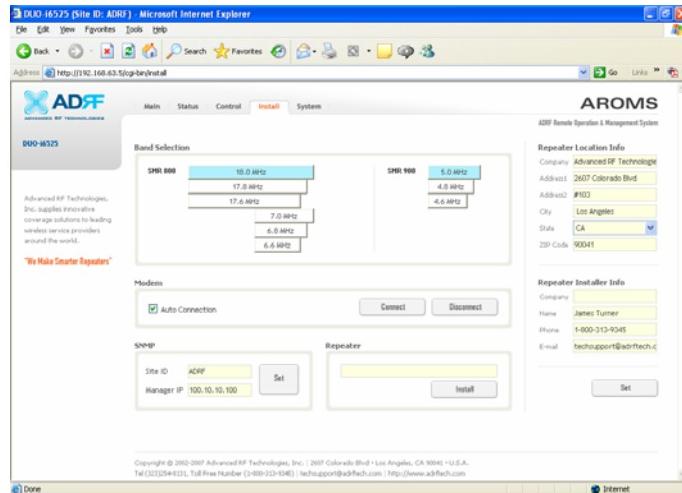
Heartbeat Time

- Heartbeat on and off (Default mode is Off)
- Heartbeat periodic time (Range: 1 to 59 min @ 1 min step – Default time is 20 min)

Alarm Setting

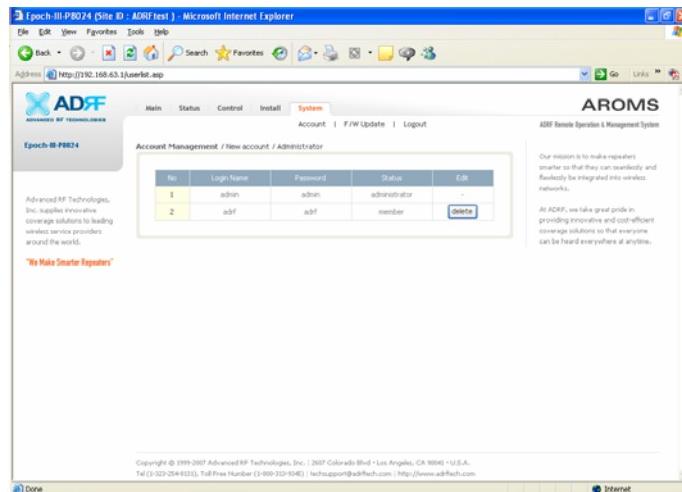
- RSSI Alarm at Donor (-95 ~ -50 dBm @ 0.5 dB step – Default value is -75 dBm)
- RF Power Alarm (2 ~ 10 dB @ 0.5 dB step – Default value is 3 dB)

vii) If you click on **Install tab**, the following window will appear:



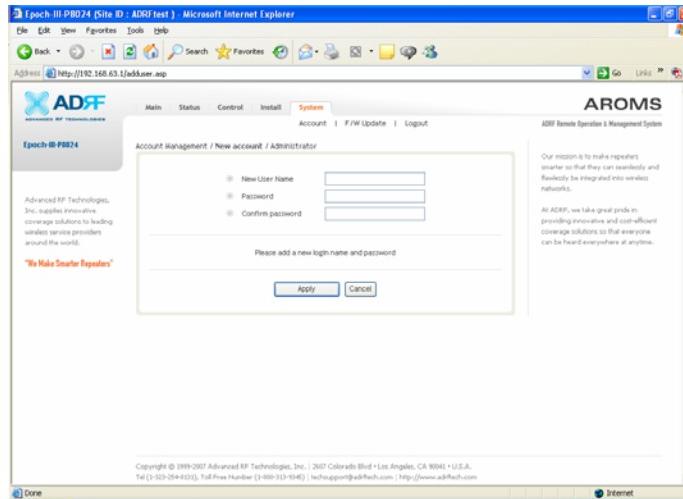
- Band Selection: Simply click on the desired operating bandwidth.
- Modem: By default, auto-connection box is checked so that the modem will connect automatically once sufficient donor signal is present.
- SNMP: Type in the assigned site/cascade ID and manager IP address. Default Site ID and Manager IP address is ADRF and 100.10.10.100 respectively.
- Repeater: Click Install button to automatically setup the repeater.
- Repeater Location: Will display the physical address where the repeater is installed
- Repeater Installer Info: Will display the installer's name, phone and e-mail Address for technical support.

viii) If you click on **System tab**, the following window will appear:

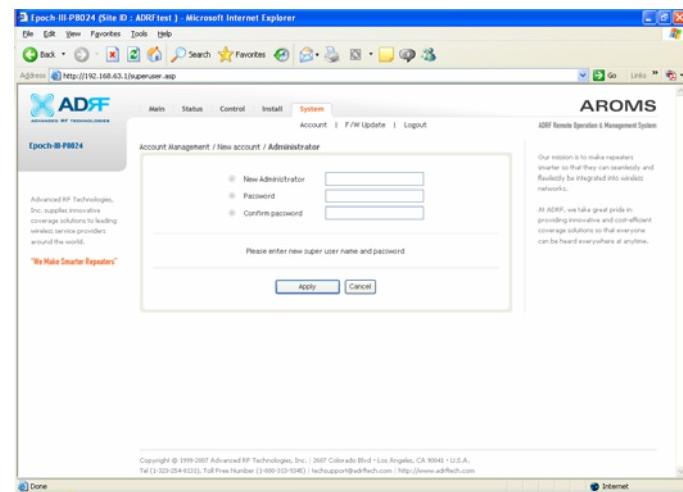


Note: If you are the Super User, you will see account management section under the System Window. If you are a local user, you will not be able to see the account management portion.

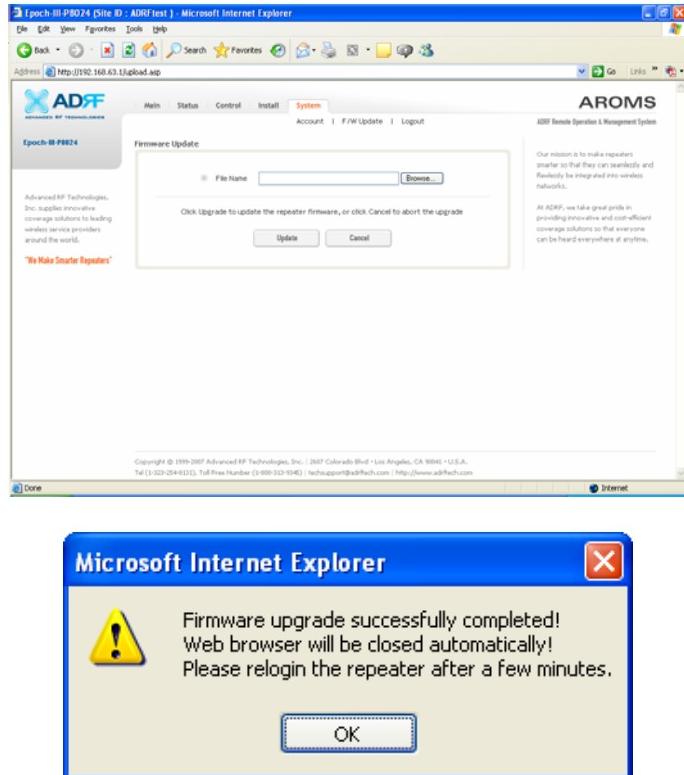
Only the Super-User can add, delete and modify a user. The following window illustrates how a new user can be added by simply clicking on New Account.



The following window illustrates how a new administrator can be added by simply clicking on Administrator.



If you click on Firmware Upgrade, the following window will appear. You can browse through your PC and locate the firmware file. Once it's selected, simply click on Update and it'll upload the latest firmware automatically and close the session. You will need to re-login again.



4. Maintenance Guide for Duo-i6525

4.1. Periodic Inspection Checklist

- a. Check for loose connections to the repeater and antennas. If connections are loose, make sure that all connections are tightly fastened properly.
- b. Cables and connectors are in good condition.
- c. Ensure that the repeater brackets are in good condition and that the repeater is securely fastened.

4.2. Preventive Measures for Optimal Operation

4.2.1. Recommendations

- Perform the *Periodic Inspection Checklist* quarterly or semiannually.

4.2.2. Precautions

- Do not operate the repeater with the antennas in extremely close proximity as this may cause damage to the repeater.
- Do not change parameters unless instructed to do so by an authorized supervisor.
- Do not move the repeater unless instructed to do so by an authorized supervisor.
- Do not detach any cables to the repeater unless repair of respective components are necessary.

5. Warranty and Repair Policy

5.1. General Warranty

The Duo-i6525 carries a Standard Warranty period of five (5) years unless indicated otherwise on the package or in the acknowledgment of the purchase order.

5.2. Limitations of Warranty

Your exclusive remedy for any defective product is limited to the repair or replacement of the defective product. Advanced RF Technologies, Inc. may elect which remedy or combination of remedies to provide in its sole discretion. Advanced RF Technologies, Inc. shall have a reasonable time after determining that a defective product exists to repair or replace the problem unit. Advanced RF Technologies, Inc. warranty applies to repaired or replaced products for the balance of the applicable period of the original warranty or ninety days from the date of shipment of a repaired or replaced product, whichever is longer.

5.3. Limitation of Damages

The liability for any defective product shall in no event exceed the purchase price for the defective product.

5.4. No Consequential Damages

Advanced RF Technologies, Inc. has no liability for general, consequential, incidental or special damages.

5.5. Additional Limitation on Warranty

Advanced RF Technologies, Inc. standard warranty does not cover products which have been received improperly packaged, altered, or physically damaged. For example, broken warranty seal, labels exhibiting tampering, physically abused enclosure, broken pins on connectors, any modifications made without Advanced RF Technologies, Inc. authorization, will void all warranty.

5.6. Return Material Authorization (RMA)

No product may be returned directly to Advanced RF Technologies, Inc. without first getting an approval from Advanced RF Technologies, Inc. If it is determined that the product may be defective, you will be given an RMA number and instructions in how to return the product. An unauthorized return, i.e., one for which an RMA number has not been issued, will be returned to you at your expense. Authorized returns are to be shipped to the address on the RMA in an approved shipping container. You will be given our courier information. It is suggested that the original box and packaging materials should be kept if an occasion arises where a defective product needs to be shipped back to Advanced RF Technologies, Inc. To request an RMA, please call (323) 254-8131 or send an email to techsupport@adrftech.com.

Appendix A: Specifications

(1) Electrical Specifications

Parameters	Specifications		Remark
Frequency	SMR800 DL	851 ~ 869 MHz or 862 ~ 869 MHz	
	SMR800 UL	806 ~ 824 MHz or 817 ~ 824 MHz	
	SMR900 DL	935 ~ 940 MHz	
	SMR900 UL	896 ~ 901 MHz	
Composite Output Power	DL	+25 dBm	
	UL	+25 dBm	
Gain Ripple	DL / UL	$\leq \pm 1.25$ dB p-p	800 + 900 MHz
Gain (DL / UL)	Maximum	65 dB	
	Range	0 ~ 25 dB	
	Step	0.5 dB	
	Tolerance	± 0.5 dB	
Roll Offs	DL / UL	≥ 65 dBc	@ 0.5 MHz outside passband
900 MHz Inter-modulation	DL 2 nd harmonic	≤ -105 dBm	At 1870 ~ 1880 MHz
Adjustable Band Edge	SMR800 DL	Default: 869 MHz Adjust: 868.8 MHz, 868.6 MHz	@ 200 kHz steps
	SMR900 DL	Default: 940 MHz Adjust: 939.8 MHz, 939.6 MHz	
ALC Range (SQE Degradation)	15 dB ALC	$\leq 10\%$	
	25 dB ALC	$\leq 20\%$	
OIP3	DL / UL	≥ 43 dBm	@ Gain 65 dB/40 dB
VSWR	DL / UL	$\leq 1.5: 1$	
Spurious RF Emission	DL / UL	≤ -13 dBm	
Noise Figure	UL	≤ 8 dB @max gain	
Delay	DL / UL	≤ 8 us	
Impedance	-	50 Ohms	

(2) Mechanical Specifications

Parameters	Specifications	Remark
Dimension	14.13 x 18.92 x 7.59 inch	359 x 480.5 x 192.5 mm
Weight	< 44 lbs	
RF Ports	N-type (F)	Donor & Server Antenna Ports
Local Interface	RJ45 (DHCP)	
Cooling	Air Convection	
IP Class	IP 20	Indoor Type
Mounting Type	Wall Mounting	19" Rack Mounting Option Available

(3) Environmental Specifications

Parameters	Specifications	Remark
Operating Temperature	-10 ~ +50 °C	Ambient
Relative Humidity	5 ~ 95 %, non-condensing	
Dust	Industrial dust per Telcordia GR63 core	

(4) Power Specifications

Parameters	Specifications	Remark
AC Power	110 ~ 125 AC	
AC Frequency	45 ~ 65 Hz	
AC Supply Protection	Fuse	
DC Power Option	-40 ~ -60 V or +20 ~ 30 V	
Power Consumption	≤ 140 W	
Ground	External Threaded Stud	

(5) Environmental Specifications

Parameters	Specifications	Remark
MTBF	> 100,000 Hours	
Certificates	UL 60950, FCC Part 90	
Warranty	5 Years	

(6) Mechanical Drawings

